SECURITY CLASSIFICATION OF THIS PAGE

**AD-A233 592**

# REPORT DOCUMENTATION PAGE

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|---|---|
| Unclassified | 1b. RESTRICTIVE MARKINGS |
| 2a. SECURITY CLASSIFICATION AUTHORITY | 3. DISTRIBUTION / AVAILABILITY OF REPORT: Approved for public release: distribution unlimited. |
| 2b. DECLASSIFICATION / DOWNGRADING SCHEDULE | |
| 4. PERFORMING ORGANIZATION REPORT NUMBER(S): Preliminary TR/11/90 | 5. MONITORING ORGANIZATION REPORT NUMBER(S): R&D 5338-CC-03 |
| 6a. NAME OF PERFORMING ORGANIZATION: Brunel University. / 6b. OFFICE SYMBOL (If applicable) | 7a. NAME OF MONITORING ORGANIZATION: USARDSG(UK) |
| 6c. ADDRESS (City, State, and ZIP Code): Uxbridge, Middlesex, UB8 3PH | 7b. ADDRESS (City, State, and ZIP Code): Box 65, FPO NY 09150-1500 |
| 8a. NAME OF FUNDING / SPONSORING ORGANIZATION: USARDSG (UK) / 8b. OFFICE SYMBOL (If applicable): AMXSN-UK-RI | 9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER: DAJA-45-87-C-0003 |
| 8c. ADDRESS (City, State, and ZIP Code): Box 65, FPO NY 09150-1500 | 10. SOURCE OF FUNDING NUMBERS: PROGRAM ELEMENT NO. 61102A; PROJECT NO. 1L161102BH57; TASK NO. 07; WORK UNIT ACCESSION NO. |

11. TITLE (Include Security Classification)

(U) Computer Assisted Analysis and Modelling of Structured Problems.

12. PERSONAL AUTHOR(S) E Hadjiconstantinou, G Mitra

| 13a. TYPE OF REPORT | 13b. TIME COVERED | 14. DATE OF REPORT (Year, Month, Day) | 15. PAGE COUNT |
|---|---|---|---|
| 7th FINAL | FROM Apr 90 TO Nov 90 | 19 December 1990 | |

16. SUPPLEMENTARY NOTATION

| 17. COSATI CODES | | | 18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number) |
|---|---|---|---|
| FIELD | GROUP | SUB-GROUP | Boolean Algebra, Inteter and Mixed Integer Linear Programme logical forms, propositional calculus, reformulation of logical forms to 0-1 MIP forms. |
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19. ABSTRACT (Continue on reverse if necessary and identify by block number)

This seventh report provides an outline of (a) research that was carried out during this period, (b) the set of investigations already initiated and (c) a specification for computer implementation of the proposed methodology. This is the final report which sets out the research work carried out successfully within this project.

During this period Dr E Hadjiconstantinou worked on the project as a part-time research investigator.



| 20. DISTRIBUTION / AVAILABILITY OF ABSTRACT | 21. ABSTRACT SECURITY CLASSIFICATION | |
|---|---|---|
| ☐ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT. ☐ DTIC USERS | Unclassified | |
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DD FORM 1473, 84 MAR — 83 APR edition may be used until exhausted. All other editions are obsolete.

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Unclassified

## 1. Focus of the Study

In this project we have studied the scope and possible application of computer based tools which can support modelling of mathematical optimisation problems. We initially investigated the method of transforming general nonlinear programming problems to variable separable form. Subsequently more research effort was directed towards developing a systematic procedure for transforming propositional calculus statements into integer and mixed integer programming models. Computer implementation of such procedures in order to achieve automatic reformulation has been an important consideration.

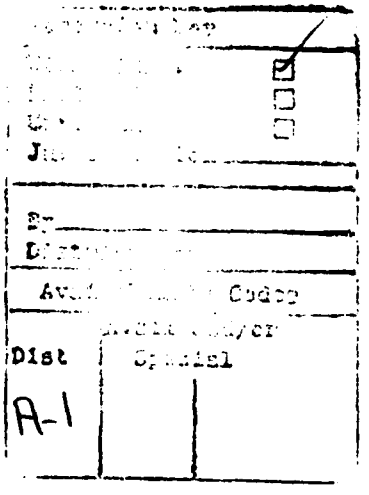
## 2. Important Results

Our investigations highlighted a very important connection between constraint logic programming and mathematical programming modelling. Thus LP modelling can be extended to include logical restrictions stated in propositional calculus form and an equivalent MIP model can be constructed authomatically by a computer based modelling support tool. A systematic procedure for reformulating logic forms to IP and MIP forms is described and illustrated by two representative examples. A blue print for integrating this automatic procedure within an interactive modelling system is then put forward. Constraint logic programming uses simple unsophisticated algorithms for constraint satisfaction. In contrast computational mathematical programming is concerned with efficient algorithms exploiting problem structure and has many instances of success in large and complex applications. The ideas put forward here add to the conceptual foundations of intelligent modelling systems for Mathematical Programming. We also hope the research reported in this project will provide motivation to bring the work of CLP and MP communities closer together.

## 3. Research Personnel

Originally Dr. C. Lucas worked on the project as a full-time research fellow. Two thirds of the way through the project Dr. Lucas took up an appointment with NAG Ltd, who are our industrial collaborator. As a result the completion of the project was delayed. We engaged Dr. E. Hadjiconstantinou of Imperial College on a part-time basis. The investigations reported in this project have been carried out by three scientists, namely

Professor G. Mitra
Dr. C. Lucas
Dr. E. Hadjiconstantinou.



## 4. Reports and Publications

There are altogether three publications and two reports. These are itemised below.

### Journal publications

J1. G. Mitra and C. Lucas, Computer assisted mathematical programming (modelling) system: CAMPS. The Computer Journal, Vol.31, No.4, 1988.

J2. G. Mitra, K. Darby-Dowman, C. Lucas and J. Yadegar, Linear, integer, separable and fuzzy programming problems: A unified approach towards reformulation. J. Opl. Res. Soc., Vol. 39, pp.161-171, 1988.

J3. G. Mitra, C. Lucas and H. Greenberg, Computer assisted modelling and analysis of linear programming probblems: Towards a unified framework. IMA Journal of Mathematics in Management, Vol.1, 1987.

### Software Manuals and Reports

R1. G. Mitra and C. Lucas, Computer Assisted Mathematical Programming (Modelling) System: CAMPS, User Reference Manual. Brunel University, 1987.

R2. G. Mitra and E. Hadjiconstantinou, Transformation of statements in propositional calculus into a system of integer linear constraints: An approach towards an automatic conversion to discrete programming models, submitted to ORSA Journal on Computing, 1990.

G. Mitra

21 January 1991